

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-101635

(43)Date of publication of application : 16.04.1996

(51)Int.Cl.

G09B 9/04
G01M 17/007
G01P 15/00

(21)Application number : 06-231070

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(22)Date of filing : 27.09.1994

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(30)Priority

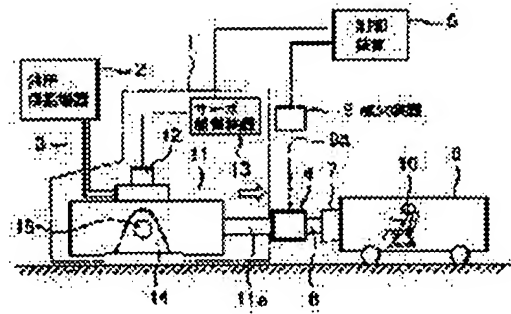
Priority number : 06181515 Priority date : 02.08.1994 Priority country : JP

(54) SIMULATOR FOR AUTOMOBILE COLLISION ACCELERATION

(57)Abstract:

PURPOSE: To provide an automobile collision acceleration (G) simulator which enables real collision simulation to be performed and can evaluate a protection device at the time of collision with high precision.

CONSTITUTION: A controller 5 outputs a collision G command signal to a servo controller 13 to start a test. The servo controller 13 controls the hydraulic pressure supplied from a hydraulic pressure supply device 2 to an actuator 1 according to the command signal to actualize target G. Further, the controller 5 outputs an ignition command signal for a separation nut to an ignition device 9 after force application by the actuator 11. The ignition device 9 supplies a current to the separation nut on the basis of the ignition command signal to explosives thereby separating a super high speed joint 4. Since the output shaft 11a of the actuator 11 stops at its stroke end, a dummy vehicle 6 is disconnected from the output shaft 11a of the actuator 11 with its inertial force and then reduced in speed to stop. Consequently, force application with the collision G including a high frequency is enabled.



CLAIMS

[Claim(s)]

[Claim 1] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The ignition which supplies the power source for ignition to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[Claim 2] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The nut decollator which supplies a separation command signal to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the automobile collision G simulator which used the ultra high-speed decollator.

[0002]

[Description of the Prior Art] The conventional automobile collision G simulator is constituted as shown in drawing 8. That is, an actuator 21 is formed to the abutment test wall 20 by which fixed installation was carried out on a floor line, and the pressurization section 23 of the simulation car 22 is located so that the actuator output-shaft 21a may be countered. A human phantom 24 is installed in the seat in the above-mentioned simulation car 22. And an air supply 25 is connected with the above-mentioned actuator 21 through the closing motion bulb 26 and the pneumatics piping 27.

[0003] In the above-mentioned configuration, in performing simulation, by opening the closing motion bulb 26 rapidly, you supply the pneumatic pressure from an air supply 25 to an actuator 21 through the pneumatics piping 27, actuator output-shaft 21a makes it collide with the pressurization section 23 of the simulation car 22, and it absorbs the reaction force at that time with an abutment test wall 20.

[0004]

[Problem(s) to be Solved by the Invention] Since the method which actuator output-shaft 21a and the simulation car 22 have separated [method] the above-mentioned conventional automobile collision G simulator, and makes actuator output-shaft 21a collide with the pressurization section 23 of the simulation car 22 is used, simulation extent of G fundamental wave is a limitation.

[0005] Moreover, although it is possible to operate a hydraulic servo valve as a joint mold which combined actuator output-shaft 21a and the simulation car 22 so that Target G may be acquired, since the stroke of an actuator becomes long, responsibility cannot worsen, and Target G cannot be acquired as a result.

[0006] While this invention was made in view of the above-mentioned actual condition and carries out the stroke of an actuator to the minimum stroke required for force application, Target G is realized by separating the actuator after force application termination, and a simulation car, and more realistic collision simulation is possible and it aims at offering the automobile collision G simulator which can perform evaluation of the protective device at the time of a collision etc. with high degree of accuracy.

[0007]

[Means for Solving the Problem] The hydraulic-pressure-supply equipment with which the automobile collision G simulator concerning this invention supplies oil pressure to an actuator and this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the ignition which supplies the power source for ignition to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[0008] Moreover, the automobile collision G simulator concerning this invention An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation

cars, It is characterized by providing the nut decollator which supplies a separation command signal to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[0009]

[Function] If a trial start signal is inputted into a control device, a control device is predetermined timing, will output a collision G command signal to a servo control means, and will start a trial. A servo control means controls the oil pressure supplied to an actuator from hydraulic-pressure-supply equipment based on a servo-system command signal, and realizes Target G.

[0010] On the other hand, a control device outputs the ignition command signal of a separation nut to an ignition after the force application termination by the actuator. An ignition supplies a current to a separation nut based on an ignition command signal, lights a powder, and separates a ultra high-speed separation joint. Since the output shaft of an actuator stops by the stroke edge, a simulation car is separated from the output shaft of an actuator by inertial force, moves that rate when dissociating, is slowed down after that and stops.

[0011] Moreover, when the ultra high-speed separation joint which does not use a powder is used, it is that a nut decollator controls a ultra high-speed separation joint according to the command from a control unit, and the same actuation as the case of the ultra high-speed separation joint which used the above-mentioned powder is performed.

[0012] Target G is given to the human phantom in a simulation car as mentioned above, and the amount of many then generated in a human phantom is measured. Consequently, while the stroke of an actuator is made to the minimum stroke required for force application, by separating the actuator after force application termination, and a simulation car, the force application of the collision G containing a RF becomes possible, and the more realistic collision simulation of it becomes possible.

[0013]

[Example] Hereafter, the example of this invention is explained with reference to a drawing.

(The 1st example) Drawing 1 is the overall block diagram of the automobile collision G simulator concerning the 1st example of this invention. In drawing 1, 1 is servo system and consists of trunnion bearing 14 which equipped the bearing of an actuator 11, a servo valve 12, a servo control 13, and a self-aligning mold. The above-mentioned trunnion bearing 14 is installed on a floor line, and holds an actuator 11 through trunnion 15. The above-mentioned servo valve 12 controls the oil pressure supplied to an actuator 11 through a hydraulic line 3 from hydraulic-pressure-supply equipment 2, and it carries out a switching action according to the command from a servo control 13. Moreover, a control command is given to this servo control 13 from the control unit 5 which manages the whole control.

[0014] And output-shaft 11a of the above-mentioned actuator 11 is connected with the simulation car 6 through the ultra high-speed separation joint 4. The human phantom 10 is installed in the seat of this simulation car 6, and when Target G is given, the amount of many generated in a human phantom 10 is measured. Moreover, the right-and-left revolving shaft 7 which equipped the above-mentioned simulation car 6 with the bearing of a self-aligning mold is established, and this right-and-left revolving shaft 7 is connected with the above-mentioned ultra high-speed separation joint 4 through a connecting shaft 8. This ultra high-speed separation joint 4 is what was constituted with the separation nut which used the powder so that a detail may be mentioned later, and firing current is supplied through electric-wire 9a for ignition from switchpoint fire equipment 9. The above-mentioned ignition 9 consists of a power source, a switch, etc. for separation nut ignition, and operates according to the control command from the above-mentioned control unit 5.

[0015] The above-mentioned control device 5 is constituted by a processor 5-1 and the servo-system command signal dispatch section 5-2 as shown in drawing 2, and a processor 5-1 starts actuation with a test initiation input signal. While a servo-system command signal is sent to the above-mentioned servo control 13

from the servo-system command signal dispatch section 5-2 by this, an ignition command signal is sent to the above-mentioned ignition 9 from a processor 5-1.

[0016] Next, drawing 3 explains the detail of the above-mentioned ultra high-speed separation joint 4. This ultra high-speed separation joint 4 carries out phase opposite of 1 set of joints which combined the joint plate 4-2 with the lock-pin 4-3, with 1 set of bolts 4-4, and the separation nut 4-5, puts a washer 4-6 into the body 4-1 of a joint of a fork mold, and combines with it. The larger bore 4-7 than the diameter of a bolt 4-4 is formed in the core of the above-mentioned joint plate 4-2, and even if the heart of the body 4-1 of a joint on either side shifts somewhat, a bolt 4-4 is attached. Separation actuation is made to perform using a powder and the above-mentioned separation nut 4-5 is U.S. Hi-Shear. "SN1100 and SN2100 series Non-Captive Separation Nuts" is put on the market from Corporation. Moreover, the separation bolt besides a separation nut is also put on the market and the same actuation can be made to perform instead of the above-mentioned separation nut 4-5 using a separation bolt.

[0017] And after the separation nut's 4-5 dissociating, it disperses, or covering 4-8 is being fixed to the body 4-1 of a joint with the fixed screw 4-9 so that the bolt 4-4 grade from which it escaped may not disperse. The above-mentioned covering 4-8 is attached, and has structure which can be removed. Moreover, electric-wire 9a for ignition from the above-mentioned ignition 9 is connected to the above-mentioned separation nut 4-5. It is fixed to the body 4-1 of a joint by the electric-wire clamp 4-10, and electric-wire 9a for ignition contacts covering 4-8, and he is trying for cutting etc. not to generate this electric-wire 9a for ignition by the impact under trial, and vibration.

[0018] When using the above-mentioned ultra high-speed separation joint 4, while forming the trunnion bearing 14 which equipped the bearing of a self-aligning mold and receiving trunnion 15 in an actuator 11 side so that bending stress with the bolt 4-4 equipped with the separation nut 4-5 impossible for etc. may not be added, in this example, the right-and-left revolving shaft 7 which the simulation car 6 side also equipped with the bearing of a self-aligning mold is established. In addition, if it is the device which the force of affecting actuation of the separation nut 4-5 does not commit, of course, other devices may be used.

[0019] Next, actuation of the above-mentioned example is explained. In case a trial is started, a trial start signal is inputted into the control unit 5 in drawing 1 by actuation of turning on a start switch. Thereby, as the processor 5-1 shown in drawing 2 operates and it is shown in drawing 4, a control unit 5 is a certain specified timing, from the servo-system command signal dispatch section 5-2, outputs a collision G command signal to servo system 1, and starts a trial. It is t_0 at this output initiation time. It is referred to as "0" of time base. A servo valve 12 is opened based on the servo-system command signal by which the servo control 13 of servo system 1 was sent from the above-mentioned servo-system command signal dispatch section 5-2, and it came, the oil pressure supplied to an actuator 11 through a hydraulic line 3 from hydraulic-pressure-supply equipment 2 is controlled, and G wave shown in drawing 4 is realized.

[0020] Moreover, the processor 5-1 in the control unit 5 shown in drawing 2 is the operating time of Δt_1 and the separation nut 4-5 about the operating time of an ignition 9 Δt_2 When it carries out, it is $\Delta t_F = \Delta t_1 + \Delta t_2$ from time base "0". - ($\Delta t_1 + \Delta t_2$)

When it passes, the ignition command signal of the separation nut 4-5 is sent, and it outputs to an ignition 9. Based on the above-mentioned ignition command signal, through electric-wire 9a for ignition, an ignition 9 supplies a current to the separation nut 4-5 from the power source for ignition, and lights a powder. The separation nut 4-5 dissociates by this, it separates from a bolt 4-4, and, as for the ultra high-speed separation joint 4, 1 set of bodies 4-1 of a joint are divided into right and left. On the other hand, since output-shaft 11a of an actuator 11 stops by the stroke edge, the simulation car 6 is separated from output-shaft 11a of an actuator 11 by inertial force, and it moves that rate when dissociating, and is Δt_2 . It slows down and stops, after ending separation.

[0021] t_0 to which measurement of data started the trial Δt_2 to which the simulation car 6 ended separation from the time up to -- it carries out. That is, as shown in drawing 4, Target G is given to a human phantom

10, and the amount of many then generated in a human phantom 10 is measured. Target G -- G fundamental-wave top -- oscillating G of a RF -- Δt_1 up to -- it is added and the condition of "0" G maintains after it -- having -- the test initiation back Δt_2 A trial is ended.

[0022] Δt_1 which started separation so that above-mentioned drawing 4 might show although there is no need for force application henceforth -- if -- Δt_2 of separation termination up to -- supposing output-shaft 11a of an actuator 11 and the simulation car 6 were combined -- which -- about -- it is as follows, when an unnecessary stroke is needed or an order check is carried out.

[0023] Generally it is Δt_1 . It is abbreviation 0.1sec (second). At this time, the simulation car 6 is maximum velocity V_{max} . It is abbreviation 15 m/sec. Therefore, the unnecessary stroke in this case is [0024].

[Equation 1]

$$\begin{aligned} \ell &\div (\Delta t_2 - \Delta t_1) V_{max} \\ &\div 3 \Delta t_1 V_{max} \\ &= 3 \times 0.1 (\text{sec}) \times 15 (\text{m/sec}) \\ &= 4.5 (\text{m}) \end{aligned}$$

It becomes. In addition, since a stroke required for force application is 1m or less, it is understood that the value of an unnecessary stroke is very large. Moreover, it is [0025] supposing separation time amount shifts 1/1000sec.

[Equation 2]

$$\begin{aligned} \Delta \ell &\div 1500 (\text{cm/sec}) \times 1 / 1000 (\text{sec}) \\ &= 1.5 (\text{cm}) \end{aligned}$$

A stroke will change.

[0026] For this reason, a decollator is Δt_2 . It is necessary to dissociate by ultra high-speed correctly. Since the mass of a separation joint influences the force application engine performance directly, it needs to collect lightweight.

[0027] Δt_1 it indicates from test initiation that described above to drawing 4 ***** -- the stroke of an actuator 11 can be shortened, the degradation by the compressibility of an oil etc. can stop, and the force application of the collision G containing a RF becomes possible by combining with the simulation car 6, carrying out force application of the output-shaft 11a of an actuator 11 through the ultra high-speed separation joint 4, operating the ultra high-speed separation joint 4 after it, and separating the simulation car 6.

[0028] In addition, when receiving a load and not going out, you may make it use it combining two separation nuts 4-5 with one separation nut, as shown in drawing 5 although the above-mentioned example explained the case where one separation nut 4-5 was used. Drawing 5 (a) is the sectional view of the ultra high-speed separation joint 4, and this drawing (b) is the side elevation. In the example shown in this drawing 5, the head of 1 set of bodies 4-1 of a joint was formed in the shape of a flange, opposite arrangement was carried out, with 2 sets of bolts 4-4, and the separation nut 4-5, the washer 4-6 was put in and that periphery section is combined. A current is supplied to two above-mentioned separation nuts 4-5 through electric-wire 9a for ignition from an ignition 9. And covering 4-8 is arranged on the outside of the body 4-1 of a joint, and it is fixing with the fixed screw 4-9. Moreover, the screwhole 4-11 for connecting the connecting shaft 8 of output-shaft 11a of an actuator 11 and the simulation car 6 is formed in the core of the body 4-1 of a joint.

[0029] A sufficiently big load can be borne by using two separation nuts 4-5 as mentioned above. Moreover, when dependability high about others, especially the separation nut 4-5 is required, it replaces with a bolt 4-4, a stud is used, and you may make it equip the both ends with the separation nut 4-5 in the ultra high-speed separation joint 4 shown in drawing 3. Thus, separation of the simulation car 6 can be ensured by using it combining two separation nuts 4-5.

[0030] (The 2nd example) Drawing 6 is the overall block diagram of the automobile collision G simulator concerning the 2nd example of this invention. This 2nd example is what used ultra high-speed separation joint 4A which replaces with the ultra high-speed separation joint 4 which used the powder, and does not use a powder, and a nut separation signal is supplied through separation signal-line 9b from nut decollator 9A. The above-mentioned nut decollator 9A consists of a power source for high-speed separation nut actuation, a relay, etc., and operates according to the control command from the above-mentioned control unit 5. Since other configurations are the same configurations as drawing 1, the same sign as drawing 1 is attached and detailed explanation is omitted.

[0031] Next, drawing 7 explains the detail of the above-mentioned ultra high-speed separation joint 4A. This ultra high-speed separation joint 4A carries out phase opposite of the body of 1 set of joints 4a, by 1 set of bolt 4b and separation nut 4c, puts in washer 4d and joins together. In this case, larger bore 4e than the diameter of bolt 4b is prepared in the core of the opposed face of the above-mentioned body of joint 4a, and even if the heart of body of joint 4a on either side shifts somewhat, bolt 4b is attached. Moreover, separation nut 4c is being beforehand fixed to one body of joint 4a by 4f of mounting bolts.

[0032] An electric and mechanical operation is made to perform separation actuation, without using a powder, and the above-mentioned separation nut 4c is U.S. G&H Technology, Inc. "Separation Nut of Model 9421-2 and Model 8500" is put on the market.

[0033] And separation signal-line 9b from above-mentioned nut decollator 9A is connected to above-mentioned separation nut 4c. It is fixed to body of joint 4a by electric-wire clamp 4g, and he is trying for faults, such as an open circuit, not to produce this separation signal-line 9b by the impact under trial, and vibration.

[0034] Also in the automobile collision G simulator of drawing 6 which used ultra high-speed separation joint 4A which does not use the above-mentioned powder, based on the directions from a control unit 5, the completely same actuation as said 1st example is performed, and the same effectiveness can be acquired.

[0035]

[Effect of the Invention] Since it was made to realize Target G by separating the actuator after force application termination, and a simulation car according to this invention while carrying out the stroke of an actuator to the minimum stroke required for force application as a full account was given above, the force application of the collision G containing a RF becomes possible, more realistic collision simulation is possible and evaluation of the protective device at the time of a collision etc. can be performed with high degree of accuracy.

TECHNICAL FIELD

[Industrial Application] This invention relates to the automobile collision G simulator which used the ultra high-speed decollator.

PRIOR ART

[Description of the Prior Art] The conventional automobile collision G simulator is constituted as shown in drawing 8 . That is, an actuator 21 is formed to the abutment test wall 20 by which fixed installation was carried out on a floor line, and the pressurization section 23 of the simulation car 22 is located so that the actuator output-shaft 21a may be countered. A human phantom 24 is installed in the seat in the above-mentioned simulation car 22. And an air supply 25 is connected with the above-mentioned actuator 21 through the closing motion bulb 26 and the pneumatics piping 27.

[0003] In the above-mentioned configuration, in performing simulation, by opening the closing motion bulb 26 rapidly, you supply the pneumatic pressure from an air supply 25 to an actuator 21 through the pneumatics piping 27, actuator output-shaft 21a makes it collide with the pressurization section 23 of the simulation car 22, and it absorbs the reaction force at that time with an abutment test wall 20.

EFFECT OF THE INVENTION

[Effect of the Invention] Since it was made to realize Target G by separating the actuator after force application termination, and a simulation car according to this invention while carrying out the stroke of an actuator to the minimum stroke required for force application as a full account was given above, the force application of the collision G containing a RF becomes possible, more realistic collision simulation is possible and evaluation of the protective device at the time of a collision etc. can be performed with high degree of accuracy.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since the method which actuator output-shaft 21a and the simulation car 22 have separated [method] the above-mentioned conventional automobile collision G simulator, and makes actuator output-shaft 21a collide with the pressurization section 23 of the simulation car 22 is used, simulation extent of G fundamental wave is a limitation.

[0005] Moreover, although it is possible to operate a hydraulic servo valve as a joint mold which combined actuator output-shaft 21a and the simulation car 22 so that Target G may be acquired, since the stroke of an actuator becomes long, responsibility cannot worsen, and Target G cannot be acquired as a result.

[0006] While this invention was made in view of the above-mentioned actual condition and carries out the stroke of an actuator to the minimum stroke required for force application, Target G is realized by separating the actuator after force application termination, and a simulation car, and more realistic collision simulation is possible and it aims at offering the automobile collision G simulator which can perform evaluation of the protective device at the time of a collision etc. with high degree of accuracy.

MEANS

[Means for Solving the Problem] The hydraulic-pressure-supply equipment with which the automobile collision G simulator concerning this invention supplies oil pressure to an actuator and this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the ignition which supplies the power source for ignition to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[0008] Moreover, the automobile collision G simulator concerning this invention An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the nut decollator which supplies a separation command signal to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

OPERATION

[Function] If a trial start signal is inputted into a control device, a control device is predetermined timing, will output a collision G command signal to a servo control means, and will start a trial. A servo control means controls the oil pressure supplied to an actuator from hydraulic-pressure-supply equipment based on a servo-system command signal, and realizes Target G.

[0010] On the other hand, a control device outputs the ignition command signal of a separation nut to an ignition after the force application termination by the actuator. An ignition supplies a current to a separation nut based on an ignition command signal, lights a powder, and separates a ultra high-speed separation joint. Since the output shaft of an actuator stops by the stroke edge, a simulation car is separated from the output shaft of an actuator by inertial force, moves that rate when dissociating, is slowed down after that and stops.

[0011] Moreover, when the ultra high-speed separation joint which does not use a powder is used, it is that a nut decollator controls a ultra high-speed separation joint according to the command from a control unit, and the same actuation as the case of the ultra high-speed separation joint which used the above-mentioned powder is performed.

[0012] Target G is given to the human phantom in a simulation car as mentioned above, and the amount of many then generated in a human phantom is measured. Consequently, while the stroke of an actuator is made to the minimum stroke required for force application, by separating the actuator after force application termination, and a simulation car, the force application of the collision G containing a RF becomes possible, and the more realistic collision simulation of it becomes possible.

EXAMPLE

[Example] Hereafter, the example of this invention is explained with reference to a drawing.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram of the automobile collision G simulator concerning the 1st example of this invention.

[Drawing 2] The block diagram showing the main configurations of the control device in this example.

[Drawing 3] Drawing in which carrying out the cross section of a part of configuration of the ultra high-speed separation joint in this example, and showing it.

[Drawing 4] Drawing for explaining the measurement actuation in this example.

[Drawing 5] Drawing showing other examples of a configuration of the ultra high-speed separation joint in this invention.

[Drawing 6] The block diagram of the automobile collision G simulator concerning the 2nd example of this invention.

[Drawing 7] Drawing in which carrying out the cross section of a part of configuration of the ultra high-speed separation joint in this example, and showing it.

[Drawing 8] The block diagram of the conventional automobile collision G simulator.

[Description of Notations].

1 Servo System

2 Hydraulic-Pressure-Supply Equipment

3 Hydraulic Line

4 4A Ultra high-speed separation joint

4-1, 4a Body of a joint

4-2 Joint Plate

4-3 Lock-pin

4-4, 4b Bolt

4-5, 4c Separation nut

4-6, 4d Washer

4-7, 4e Bore

4-8 Covering

4-9 Fixed Screw

4-10, 4g Electric-wire clamp

5 Control Unit

6 Simulation Car

7 Right-and-Left Revolving Shaft

8 Connecting Shaft

9 Ignition

10 Human Phantom

11 Actuator

11a Actuator output shaft

12 Servo Valve

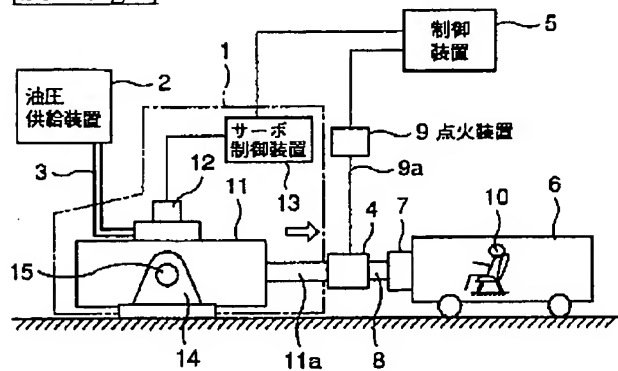
13 Servo Control

14 Trunnion Bearing

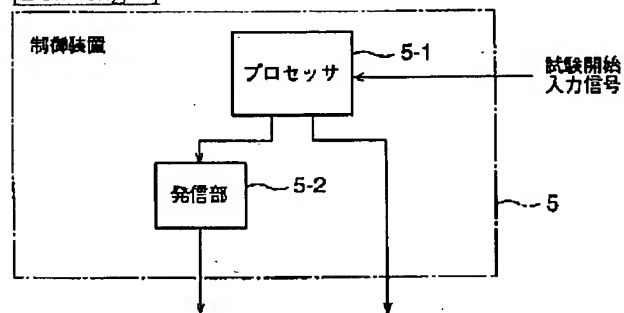
15 Trunnion

DRAWINGS

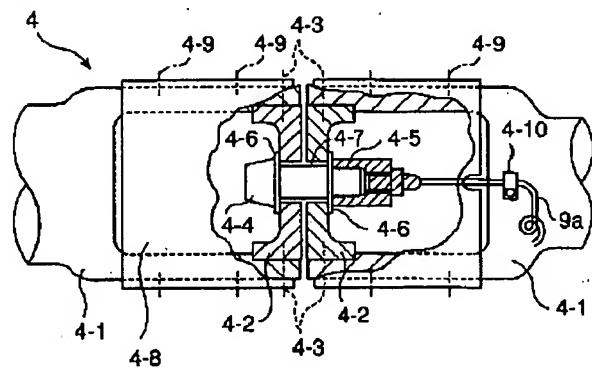
[Drawing 1]



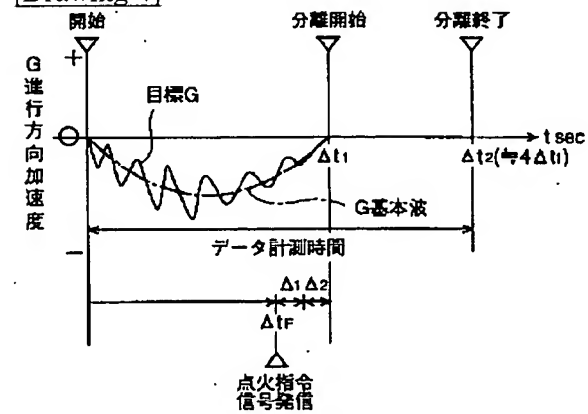
[Drawing 2]



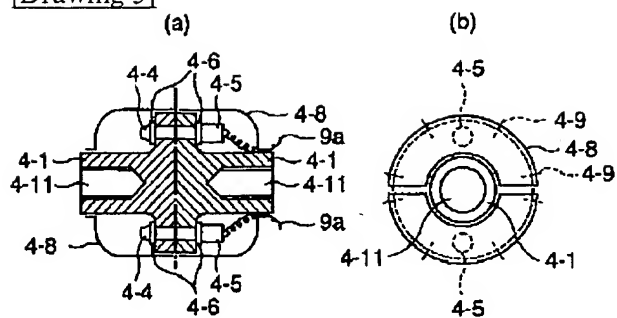
[Drawing 3]



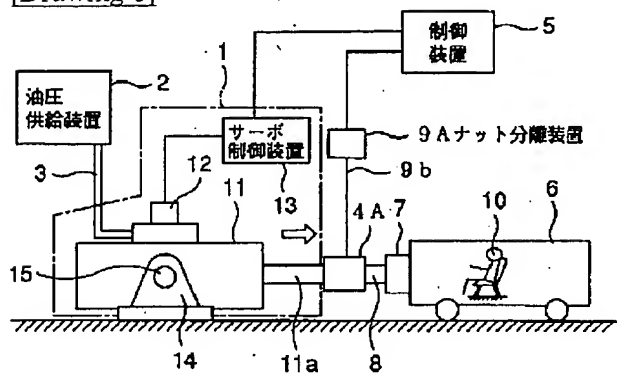
[Drawing 4]



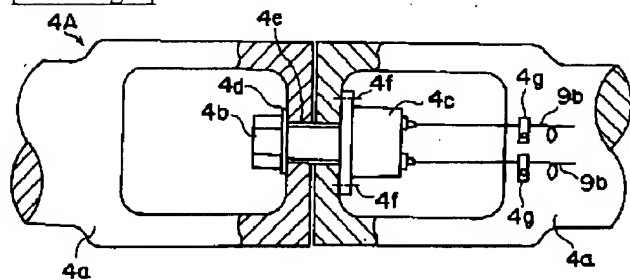
[Drawing 5]



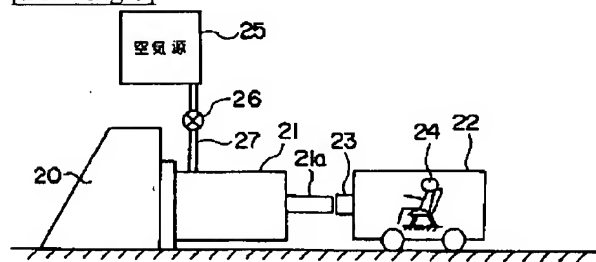
[Drawing 6]



[Drawing 7]



[Drawing 8]



WRITTEN AMENDMENT

----- [a procedure revision]

[Filing Date] January 11, Heisei 7

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[Proposed Amendment]

[Claim(s)]

[Claim 1] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The ignition which supplies the power source for ignition to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[Claim 2] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The nut decollator which supplies a separation command signal to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0007

[Method of Amendment] Modification

[Proposed Amendment]

[0007]

[Means for Solving the Problem] The hydraulic-pressure-supply equipment with which the automobile collision G simulator concerning this invention supplies oil pressure to an actuator and this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the ignition which supplies the power source for ignition to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0008

[Method of Amendment] Modification

[Proposed Amendment]

[0008] Moreover, the automobile collision G simulator concerning this invention An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the nut decollator which supplies a separation command signal to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0019

[Method of Amendment] Modification

[Proposed Amendment]

[0019] Next, actuation of the above-mentioned example is explained. In case a trial is started, a trial start signal is inputted into the control unit 5 in drawing 1 by actuation of turning on a start switch. Thereby, as the processor 5-1 shown in drawing 2 operates and it is shown in drawing 4 , a control unit 5 is a certain specified timing, from the servo-system command signal dispatch section 5-2, outputs a collision G command signal to servo system 1, and starts a trial. It is t0 at this output initiation time. It is referred to as "0" of time base. A servo valve 12 is opened based on the servo-system command signal by which the servo control 13 of servo system 1 was sent from the above-mentioned servo-system command signal dispatch section 5-2, and it came, the oil pressure supplied to an actuator 11 through a hydraulic line 3 from hydraulic-pressure-supply equipment 2 is controlled, and the target G wave shown in drawing 4 is realized.

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0020

[Method of Amendment] Modification

[Proposed Amendment]

[0020] Moreover, the processor 5-1 in the control unit 5 shown in drawing 2 is the operating time of delta 1 and the separation nut 4-5 about the operating time of an ignition 9 delta 2 When it carries out, it is from time base "0",

$\text{deltatF} = \text{deltat1} - (\text{delta1} + \text{delta2})$

When it passes, the ignition command signal of the separation nut 4-5 is sent, and it outputs to an ignition 9. Based on the above-mentioned ignition command signal, through electric-wire 9a for ignition, an ignition 9 supplies a current to the separation nut 4-5 from the power source for ignition, and lights a powder. The separation nut 4-5 dissociates by this, it separates from a bolt 4-4, and, as for the ultra high-speed separation joint 4, 1 set of bodies 4-1 of a joint are divided into right and left. On the other hand, since output-shaft 11a of an actuator 11 stops by the stroke edge, the simulation car 6 is separated from output-shaft 11a of an actuator 11 by inertial force, and it moves that rate when dissociating, and is deltat2. It slows down and stops, after ending a trial.

[Procedure amendment 6]

[Document to be Amended] Specification

[Item(s) to be Amended] 0021

[Method of Amendment] Modification

[Proposed Amendment]

[0021] t0 to which measurement of data started the trial A point in time to deltat2 up to -- it carries out. That is, as shown in drawing 4 , Target G is given to the simulation car 6, and the amount of many then generated in a human phantom 10 is measured. Target G -- G fundamental-wave top -- oscillating G of a RF -- deltat1 up to -- it is added and the condition of "0" G maintains after it -- having -- the test initiation back deltat2 A trial is ended.

[Procedure amendment 7]

[Document to be Amended] Specification

[Item(s) to be Amended] 0022

[Method of Amendment] Modification

[Proposed Amendment]

[0022] deltat1 separated so that above-mentioned drawing 4 might show although there is no need for force application henceforth -- if -- deltat2 of test termination up to -- supposing output-shaft 11a of an actuator 11 and the simulation car 6 were combined -- which -- about -- it is as follows, when an unnecessary stroke is needed or an order check is carried out.

[Procedure amendment 8]

[Document to be Amended] Specification

[Item(s) to be Amended] 0026

[Method of Amendment] Modification

[Proposed Amendment]

[0026] For this reason, a decollator is deltat1. It is necessary to dissociate by ultra high-speed correctly. Since the mass of a separation joint influences the force application engine performance directly, it needs to collect lightweight.

[Procedure amendment 9]

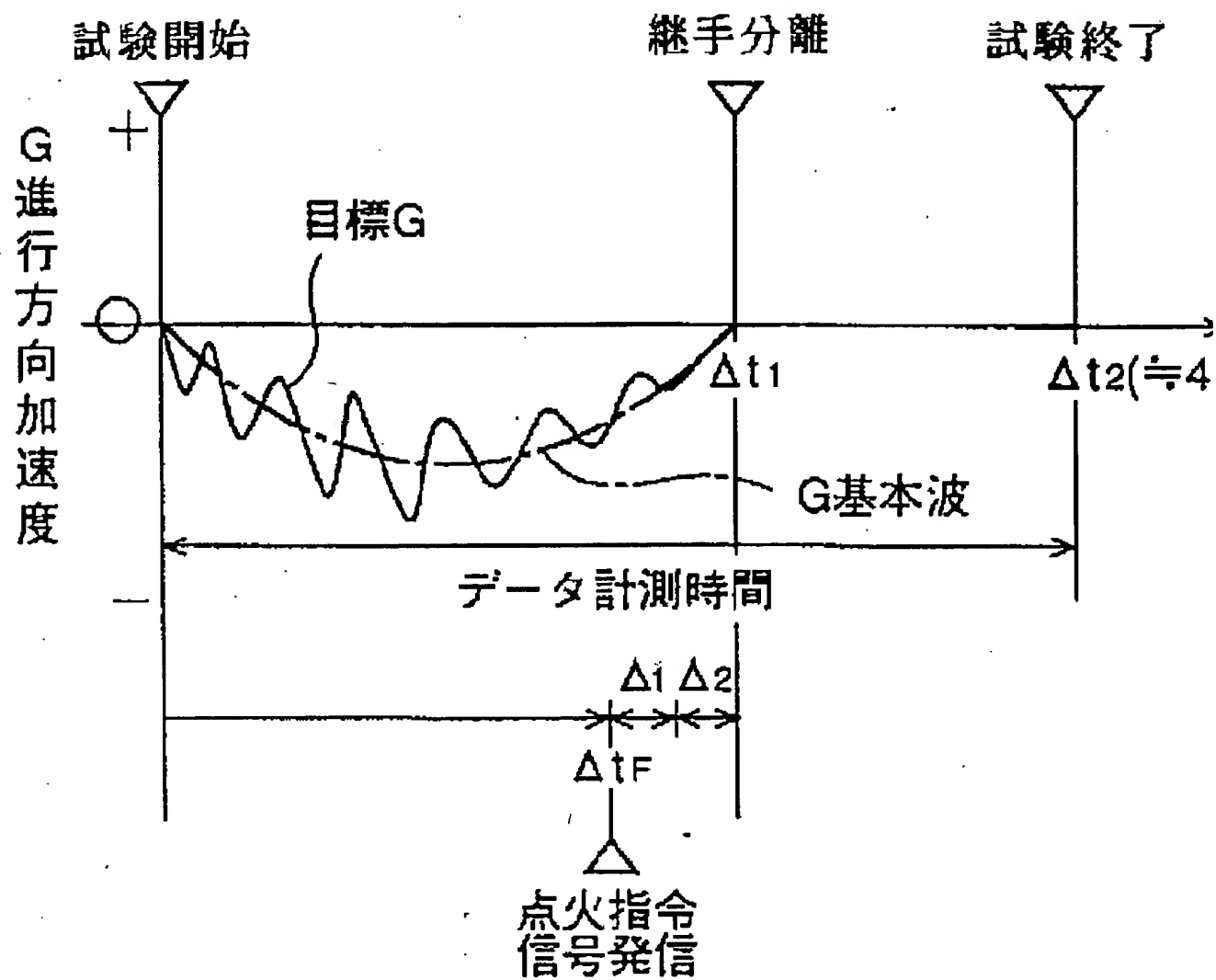
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] drawing 4

[Method of Amendment] Modification

[Proposed Amendment]

[Drawing 4]



(19)日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平8-101635

(43)公開日 平成8年(1996)4月16日

(51)Int.Cl.*	識別記号	庁内整理番号	F I	技術表示箇所
G 0 9 B 9/04		Z		
G 0 1 M 17/007				
G 0 1 P 15/00		D		
			G 0 1 M 17/ 00	Z

審査請求 有 請求項の数2 OL (全 8 頁)

(21)出願番号 特願平6-231070

(22)出願日 平成6年(1994)9月27日

(31)優先権主張番号 特願平6-181515

(32)優先日 平6(1994)8月2日

(33)優先権主張国 日本 (J P)

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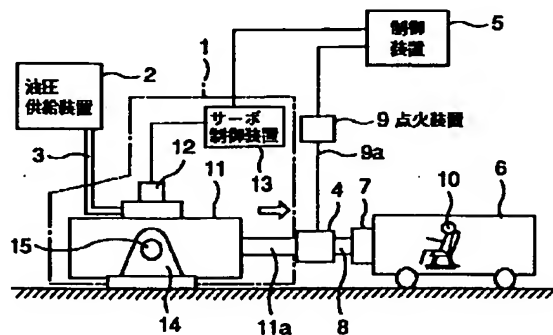
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(54)【発明の名称】 自動車衝突Gシミュレータ

(57)【要約】

【目的】 より現実的な衝突シミュレーションが可能で、衝突時の保護装置の評価等を高精度で行なうことができる自動車衝突Gシミュレータを提供する。

【構成】 制御装置5は、サーボ制御装置13に衝突G指令信号を出力して試験を開始する。サーボ制御装置13は、指令信号に基づいて油圧供給装置2からアクチュエータ11に供給される油圧を制御し、目標Gを実現させる。また、制御装置5は、アクチュエータ11による加力終了後、分離ナットの点火指令信号を点火装置9に出力する。点火装置9は、点火指令信号に基づき分離ナットに電流を供給して火薬を点火し、超高速分離継手4を分離する。アクチュエータ11の出力軸11aは、そのストローク端で停止するので、模擬車両6は慣性力によりアクチュエータ11の出力軸11aから切り離され、その後、減速して停止する。この結果、高周波を含む衝突Gの加力が可能になる。



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【特許請求の範囲】

【請求項1】 アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【請求項2】 アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、超高速分離装置を用いた自動車衝突Gシミュレータに関する。

【0002】

【従来の技術】 従来の自動車衝突Gシミュレータは、図8に示すように構成されている。即ち、床面上に固定設置された反力壁20に対してアクチュエータ21を設け、そのアクチュエータ出力軸21aに対向するように模擬車両22の加圧部23を位置させている。上記模擬車両22内の座席には、人体模型24が設置される。そして、上記アクチュエータ21には、空気源25が開閉バルブ26及び空圧配管27を介して連結される。

【0003】 上記の構成において、シミュレーションを行なう場合には、開閉バルブ26を急激に開くことにより、空気源25からの空気を空圧配管27を通してアクチュエータ21に供給し、アクチュエータ出力軸21aが模擬車両22の加圧部23に衝突させ、その時の反力は反力壁20で吸収する。

【0004】

【発明が解決しようとする課題】 上記従来の自動車衝突Gシミュレータは、アクチュエータ出力軸21aと模擬車両22が分離しており、アクチュエータ出力軸21aを模擬車両22の加圧部23に衝突させる方式を用いているため、G基本波の模擬程度が限界である。

【0005】 また、アクチュエータ出力軸21aと模擬車両22を結合した結合型として油圧サーボバルブを目

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標Gが得られるように作動させることは可能であるが、アクチュエータのストロークが長くなるために応答性が悪くなり、結果として目標Gを得ることができない。

【0006】 本発明は上記実情に鑑みてなされたもので、アクチュエータのストロークを加力に必要な最小ストロークにすると共に、加力終了後アクチュエータと模擬車両を切り離すことで目標Gを実現させ、より現実的な衝突シミュレーションが可能で、衝突時の保護装置の評価等を高精度で行なうことができる自動車衝突Gシミュレータを提供することを目的とする。

【0007】

【課題を解決するための手段】 本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【0008】 また、本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【0009】

【作用】 試験開始信号を制御装置に入力すると、制御装置は、所定のタイミングで、サーボ制御手段に衝突G指令信号を出力して試験を開始する。サーボ制御手段は、サーボ系指令信号に基づいて油圧供給装置からアクチュエータに供給される油圧を制御し、目標Gを実現させる。

【0010】 一方、制御装置は、アクチュエータによる加力終了後、分離ナットの点火指令信号を点火装置に出力する。点火装置は、点火指令信号に基づき分離ナットに電流を供給して火薬を点火し、超高速分離継手を分離する。アクチュエータの出力軸は、そのストローク端で停止するので、模擬車両は慣性力によりアクチュエータの出力軸から切り離され、その分離した時の速度で移動し、その後、減速して停止する。

【0011】 また、火薬を使用しない超高速分離継手を

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使用した場合においては、ナット分離装置が制御装置からの指令に従って超高速分離継手を制御することで、上記火薬を使用した超高速分離継手の場合と同様の動作が行なわれる。

【0012】上記のようにして目標Gを模擬車両内の人体模型に与え、そのとき人体模型に発生する諸量を計測する。この結果、アクチュエータのストロークを加力に必要な最小ストロークにできると共に、加力終了後アクチュエータと模擬車両を切り離すことにより、高周波を含む衝突Gの加力が可能になり、より現実的な衝突シミュレーションが可能となる。

【0013】

【実施例】以下、図面を参照して本発明の実施例を説明する。

(第1実施例) 図1は、本発明の第1実施例に係る自動車衝突Gシミュレータの全体的な構成図である。図1において、1はサーボ系で、アクチュエータ11、サーボバルブ12、サーボ制御装置13、及び自動調心型の軸受けを装備したトラニオン軸受14から構成されている。上記トラニオン軸受14は、床面上に設置され、トラニオン軸15を介してアクチュエータ11を保持する。上記サーボバルブ12は、油圧供給装置2から油圧配管3を介してアクチュエータ11に供給される油圧を制御するもので、サーボ制御装置13からの指令に従って開閉動作する。また、このサーボ制御装置13には、全体の制御を司る制御装置5から制御指令が与えられる。

【0014】そして、上記アクチュエータ11の出力軸11aは、超高速分離継手4を介して模擬車両6に連結される。この模擬車両6の座席には、人体模型10が設置されており、目標Gが与えられたときに人体模型10に発生する諸量を計測するようになっている。また、上記模擬車両6には、自動調心型の軸受けを装備した左右回転軸7が設けてあり、この左右回転軸7が連結軸8を介して上記超高速分離継手4に連結される。この超高速分離継手4は、詳細を後述するように火薬を使用した分離ナット等により構成したもので、スイッチ点火装置9より点火用電線9aを介して点火電流が供給される。上記点火装置9は、分離ナット点火用の電源及びスイッチ等よりなり、上記制御装置5からの制御指令に従って動作する。

【0015】上記制御装置5は、図2に示すようにプロセッサ5-1及びサーボ系指令信号発信部5-2により構成されており、試験開始入力信号によりプロセッサ5-1が動作を開始する。これによりサーボ系指令信号発信部5-2から上記サーボ制御装置13にサーボ系指令信号が送られると共に、プロセッサ5-1から上記点火装置9に点火指令信号が送られる。

【0016】次に図3により上記超高速分離継手4の詳細について説明する。この超高速分離継手4は、フォー

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ク型の継手本体4-1に、結合板4-2を固定ピン4-3で結合した1組の継手を相対向させ、1組のボルト4-4及び分離ナット4-5でワッシャ4-6を入れて結合する。上記結合板4-2の中心部には、ボルト4-4の直径より大きい透孔4-7が設けられており、左右の継手本体4-1の芯が多少ずれても、ボルト4-4が取り付けられるようになっている。上記分離ナット4-5は、火薬を使用して分離動作を行なわせるもので、例えば米国のHi-Shear Corporationより「SN1100 and SN2100 series Non-Captive Separation Nuts」が発売されている。また、分離ナットの他、分離ボルトも発売されており、上記分離ナット4-5の代わりに分離ボルトを使用して同様の動作を行なわせることができる。

【0017】そして、分離ナット4-5が分離後、飛散したり、抜けたボルト4-4等が飛散しないようにカバー4-8が継手本体4-1に固定ネジ4-9で固定されている。上記カバー4-8は、取付け、取外しが可能な構造になっている。また、上記分離ナット4-5には、上記点火装置9からの点火用電線9aが接続される。この点火用電線9aは、電線クランプ4-10により、継手本体4-1に固定され、試験中の衝撃、振動により、点火用電線9aがカバー4-8に接触して切断等が発生しないようにしている。

【0018】上記超高速分離継手4を使用する場合、この実施例では分離ナット4-5を装着したボルト4-4に無理な曲げ応力等が加わらないように、アクチュエータ11側に自動調心型の軸受けを装備したトラニオン軸受14を設けてトラニオン軸15を受けると共に、模擬車両6側でも自動調心型の軸受けを装備した左右回転軸7を設けている。なお、分離ナット4-5の作動に影響を与える力が働かないような機構であれば、その他の機構を用いても良いことは勿論である。

【0019】次に上記実施例の動作を説明する。試験を開始する際、スタートスイッチをONするなどの操作により、試験開始信号を図1における制御装置5に入力する。これにより制御装置5は、図2に示すプロセッサ5-1が作動し、図4に示すように、ある規定されたタイミングで、サーボ系指令信号発信部5-2よりサーボ系1に対し衝突G指令信号を出力して試験を開始する。この出力開始時点t0を時間基準の“0”とする。サーボ系1のサーボ制御装置13は、上記サーボ系指令信号発信部5-2から送られてきたサーボ系指令信号に基づいてサーボバルブ12を開き、油圧供給装置2から油圧配管3を介してアクチュエータ11に供給される油圧を制御し、図4に示すG波形を実現させる。

【0020】また、図2に示す制御装置5内のプロセッサ5-1は、点火装置9の作動時間を $\Delta 1$ 、分離ナット4-5の作動時間を $\Delta 2$ とすると、時間基準“0”より、

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$$\Delta t_F = \Delta t_1 - (\Delta t_1 + \Delta t_2)$$

を経過した時点で、分離ナット4-5の点火指令信号を発信し、点火装置9に出力する。点火装置9は、上記点火指令信号に基づき点火用電線9aを介して分離ナット4-5に点火用電源より電流を供給して火薬を点火する。これにより分離ナット4-5が分離してボルト4-4から外れ、超高速分離継手4は1組の継手本体4-1が左右に分かれる。一方、アクチュエータ11の出力軸11aは、そのストローク端で停止するので、模擬車両6は慣性力によりアクチュエータ11の出力軸11aから切り離され、その分離した時の速度で移動し、 Δt_2 で分離を終了した後、減速して停止する。

【0021】データの計測は、試験を開始した t_0 時点から模擬車両6が分離を終了した Δt_2 まで行なう。即ち、図4に示すように目標Gを人体模型10に与え、そのとき人体模型10に発生する諸量を計測する。目標Gは、G基本波の上に高周波の振動的Gが Δt_1 まで加わり、それ以後は“0”Gの状態が保たれ、試験開始後 Δt_2 で試験を終了する。

【0022】上記図4から分かるように分離を開始した Δt_1 以後は、加力の必要はないが、もし、分離終了の Δt_2 までアクチュエータ11の出力軸11aと模擬車両6が結合されていたとすると、どの位不要のストロークを必要とするか、オーダチェックすると次のようになる。

【0023】一般に Δt_1 は、略0.1sec(秒)である。このとき模擬車両6は、最大速度 V_{max} が略15m/secとなっている。従って、この場合の不要なストロークは、

【0024】

【数1】

$$\begin{aligned} l &= (\Delta t_2 - \Delta t_1) V_{max} \\ &\approx 3 \Delta t_1 V_{max} \\ &= 3 \times 0.1(\text{sec}) \times 15(\text{m/sec}) \\ &= 4.5(\text{m}) \end{aligned}$$

となる。なお、加力に必要なストロークは1m以下であるので、不要なストロークの値が非常に大きいことが分かる。また、分離時間が1/1000secずれるとすると、

【0025】

【数2】

$$\begin{aligned} \Delta l &\approx 1500(\text{cm/sec}) \times 1/1000(\text{sec}) \\ &= 1.5(\text{cm}) \end{aligned}$$

ストロークが変化することになる。

【0026】このため分離装置は、 Δt_2 で正確に、かつ、超高速で分離する必要がある。分離継手の質量は、加力性能に直接影響するので、軽量にまとめることが必

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要である。

【0027】上記したよう試験開始から図4に示す Δt_1 までは、アクチュエータ11の出力軸11aを超高速分離継手4を介して模擬車両6と結合して加力し、それ以後は、超高速分離継手4を作動させて模擬車両6を分離することにより、アクチュエータ11のストロークを短くして油の圧縮性等による性能低下を抑えることができ、高周波を含む衝突Gの加力が可能になる。

【0028】なお、上記実施例では、1本の分離ナット4-5を用いた場合について説明したが、1本の分離ナットでは荷重を受け切れないような時には、図5に示すように2本の分離ナット4-5を組合わせて使用するようにしてもよい。図5(a)は超高速分離継手4の断面図、同図(b)はその側面図である。この図5に示す実施例では、1組の継手本体4-1の頭部をフランジ状に形成して対向配置し、その周縁部を2組のボルト4-4及び分離ナット4-5により、ワッシャ4-6を入れて結合している。上記2本の分離ナット4-5には、点火装置9から点火用電線9aを介して電流を供給する。そして、継手本体4-1の外側にカバー4-8を配置し、固定ネジ4-9で固定している。また、継手本体4-1の中心部には、アクチュエータ11の出力軸11a、模擬車両6の連結軸8を連結するためのネジ孔4-11を設けている。

【0029】上記のように2本の分離ナット4-5を用いることにより、充分大きな荷重に耐えることができる。また、その他、特に分離ナット4-5について高い信頼性が要求される場合には、図3に示した超高速分離継手4において、ボルト4-4に代えてスタッドを使用し、その両端に分離ナット4-5を装着するようにしてもよい。このように2つの分離ナット4-5を組合わせて使用することにより、模擬車両6の分離をより確実に行なうことができる。

【0030】(第2実施例)図6は、本発明の第2実施例に係る自動車衝突Gシミュレータの全体的な構成図である。この第2実施例は、火薬を使用した超高速分離継手4に代えて火薬を用いない超高速分離継手4Aを使用したもので、ナット分離装置9Aより分離信号線9bを介してナット分離信号が供給される。上記ナット分離装置9Aは、高速分離ナット作動用の電源、リレー等よりなり、上記制御装置5からの制御指令に従って動作する。その他の構成は、図1と同様の構成であるので、図1と同一符号を付して詳細な説明は省略する。

【0031】次に上記超高速分離継手4Aの詳細について図7により説明する。この超高速分離継手4Aは、1組の継手本体4aを相対向させ、1組のボルト4b及び分離ナット4cでワッシャ4dを入れて結合する。この場合、上記継手本体4aの対向面の中心部には、ボルト4bの直径より大きい透孔4eが設けられており、左右の継手本体4aの芯が多少ずれても、ボルト4bが取り

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付けられるようになっている。また、分離ナット4cは、一方の継手本体4aに取付ボルト4fにより予め固定されている。

【0032】上記分離ナット4cは、火薬を使用せずに電氣的及び機械的な作用により分離動作を行なわせるもので、例えば米国のG&H Technology, Inc. より「Model 9421-2、Model 8500のSeparation Nut」が発売されている。

【0033】そして、上記分離ナット4cには、上記ナット分離装置9Aからの分離信号線9bが接続される。この分離信号線9bは、電線クランプ4gにより、継手本体4aに固定され、試験中の衝撃、振動により、断線等の不具合が生じないようにしている。

【0034】上記火薬を用いない超高速分離継手4Aを使用した図6の自動車衝突Gシミュレータにおいても、制御装置5からの指示に基づいて前記第1実施例と全く同様の動作が行なわれ、同様の効果を得ることができる。

【0035】

【発明の効果】以上詳記したように本発明によれば、アクチュエータのストロークを加力に必要な最小ストロークにすると共に、加力終了後アクチュエータと模擬車両を切り離すことにより目標Gを実現するようにしたので、高周波を含む衝突Gの加力が可能になり、より現実的な衝突シミュレーションが可能で、衝突時の保護装置の評価等を高精度で行なうことができる。

【図面の簡単な説明】

【図1】本発明の第1実施例に係る自動車衝突Gシミュレータの構成図。

【図2】同実施例における制御装置の主要構成を示すブロック図。

【図3】同実施例における超高速分離継手の構成を一部断面して示す図。

【図4】同実施例における計測動作を説明するための図。

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【図5】本発明における超高速分離継手の他の構成例を示す図。

【図6】本発明の第2実施例に係る自動車衝突Gシミュレータの構成図。

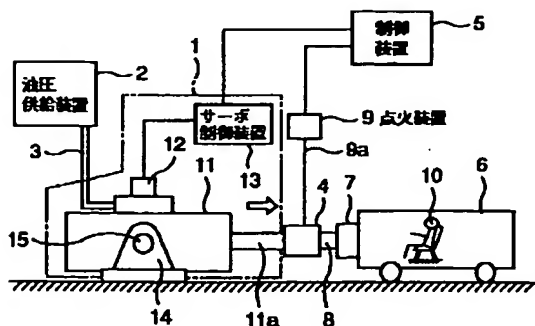
【図7】同実施例における超高速分離継手の構成を一部断面して示す図。

【図8】従来の自動車衝突Gシミュレータの構成図。

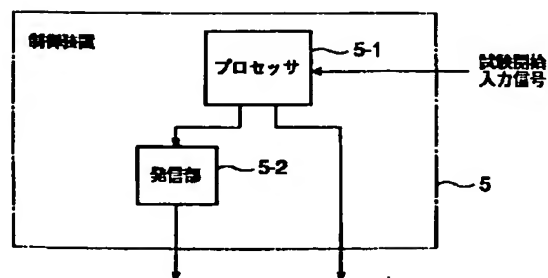
【符号の説明】

- 1 サーボ系
- 2 油圧供給装置
- 3 油圧配管
- 4, 4A 超高速分離継手
- 4-1, 4a 継手本体
- 4-2 結合板
- 4-3 固定ピン
- 4-4, 4b ボルト
- 4-5, 4c 分離ナット
- 4-6, 4d ワッシャ
- 4-7, 4e 透孔
- 4-8 カバー
- 4-9 固定ネジ
- 4-10, 4g 電線クランプ
- 5 制御装置
- 6 模擬車両
- 7 左右回転軸
- 8 連結軸
- 9 点火装置
- 10 人体模型
- 11 アクチュエータ
- 11a アクチュエータ出力軸
- 12 サーボバルブ
- 13 サーボ制御装置
- 14 トラニオン軸受
- 15 トラニオン軸

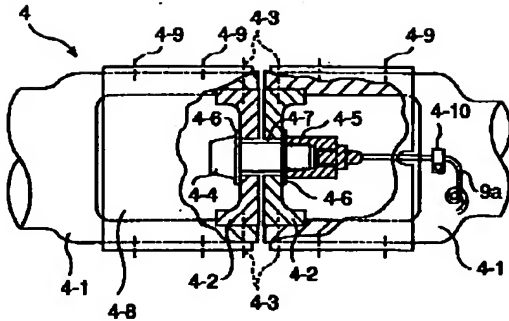
【図1】



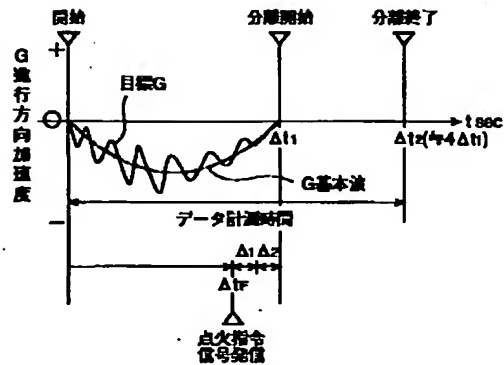
【図2】



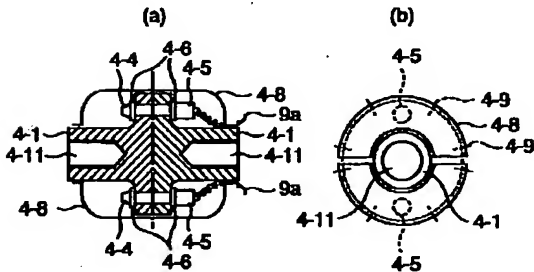
【図3】



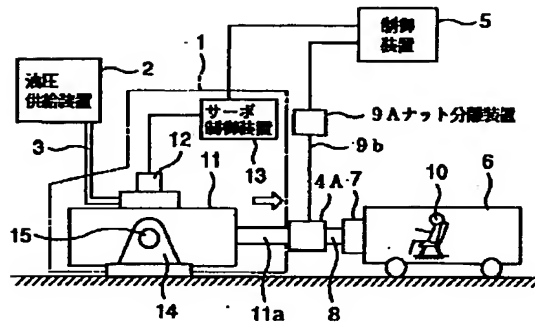
【図4】



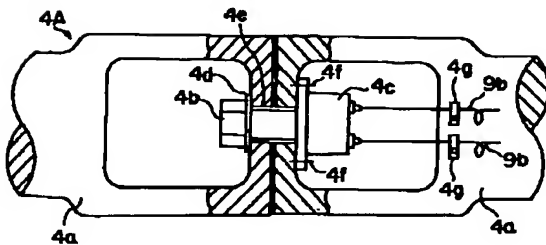
【図5】



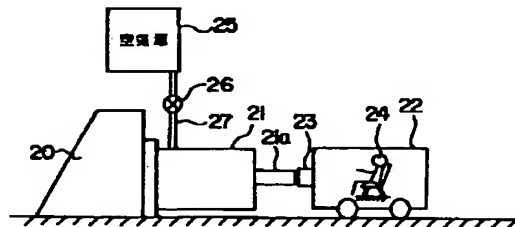
【図6】



【図7】



【図8】



【手続補正書】

【提出日】平成7年1月11日

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】特許請求の範囲

【補正方法】変更

【補正内容】

【特許請求の範囲】

【請求項1】 アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置が

ら上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【請求項2】 アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【手続補正2】

【補正対象書類名】明細書

【補正対象項目名】0007

【補正方法】変更

【補正内容】

【0007】

【課題を解決するための手段】本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【手続補正3】

【補正対象書類名】明細書

【補正対象項目名】0008

【補正方法】変更

【補正内容】

【0008】また、本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【手続補正4】

【補正対象書類名】明細書

【補正対象項目名】0019

【補正方法】変更

【補正内容】

【0019】次に上記実施例の動作を説明する。試験を開始する際、スタートスイッチをONするなどの操作により、試験開始信号を図1における制御装置5に入力する。これにより制御装置5は、図2に示すプロセッサ5-1が作動し、図4に示すように、ある規定されたタイミングで、サーボ系指令信号発信部5-2よりサーボ系1に対し衝突G指令信号を出力して試験を開始する。この出力開始時点 t_0 を時間基準の“0”とする。サーボ系1のサーボ制御装置13は、上記サーボ系指令信号発信部5-2から送られきたサーボ系指令信号に基づいてサーボバルブ12を開き、油圧供給装置2から油圧配管3を介してアクチュエータ11に供給される油圧を制御し、図4に示す且度G波形を実現させる。

【手続補正5】

【補正対象書類名】明細書

【補正対象項目名】0020

【補正方法】変更

【補正内容】

【0020】また、図2に示す制御装置5内のプロセッサ5-1は、点火装置9の作動時間を Δt_1 、分離ナット4-5の作動時間を Δt_2 とすると、時間基準“0”より、

$$\Delta t_F = \Delta t_1 - (\Delta t_1 + \Delta t_2)$$

を経過した時点で、分離ナット4-5の点火指令信号を発信し、点火装置9に出力する。点火装置9は、上記点火指令信号に基づき点火用電線9aを介して分離ナット4-5に点火用電源より電流を供給して火薬を点火する。これにより分離ナット4-5が分離してボルト4-4から外れ、超高速分離継手4は1組の継手本体4-1が左右に分かれる。一方、アクチュエータ11の出力軸11aは、そのストローク端で停止するので、模擬車両6は慣性力によりアクチュエータ11の出力軸11aから切り離され、その分離した時の速度で移動し、 Δt_2 で試験を終了した後、減速して停止する。

【手続補正6】

【補正対象書類名】明細書

【補正対象項目名】0021

【補正方法】変更

【補正内容】

【0021】データの計測は、試験を開始した t_0 時点から Δt_2 まで行なう。即ち、図4に示すように目標Gを模擬車両6に与え、そのとき人体模型10に発生する諸量等を計測する。目標Gは、G基本波の上に高周波の振動的Gが Δt_1 まで加わり、それ以後は“0”Gの状態が保たれ、試験開始後 Δt_2 で試験を終了する。

【手続補正7】

【補正対象書類名】明細書

【補正対象項目名】0022

【補正方法】変更

【補正内容】

【0022】上記図4から分かるように分離した Δt_1 以後は、加力の必要はないが、もし、試験終了の Δt_2 までアクチュエータ11の出力軸11aと模擬車両6が結合されていたとすると、どの位不要のストロークを必要とするか、オーダチェックすると次のようになる。

【手続補正8】

【補正対象書類名】明細書

【補正対象項目名】0026

【補正方法】変更

【補正内容】

【0026】このため分離装置は、 Δt_1 で正確に、かつ、超高速で分離する必要がある。分離継手の質量は、加力性能に直接影響するので、軽量にまとめることが必要である。

【手続補正9】

【補正対象書類名】図面

【補正対象項目名】図4

【補正方法】変更

【補正内容】

【図4】

